HONG KONG MONETARY AUTHORITY
香港金融管理局

Interest Rate Risk in the Banking Book

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Overview

Interest rate risk in the banking book (IRRBB):

- is "the current or prospective risk to the bank's **capital and earnings** arising from **adverse movements in interest rates** that affect the bank's **banking book** positions";*
  Example: **Maturity mismatch** as source of profit and interest rate risk;

- can be **sizable** from individual bank as well as system-wide perspectives;
  Example, S&L crisis: net income of -$4.6B and 112 insolvent institutions in S&L industry in 1981;†

- is **addressed by regulatory authorities** following the Basel Committee on Banking Supervision's (BCBS) standards.

*BCBS (2016)
†FDIC (1997)

Agenda

- Historical Overview
- IRRBB: The BCBS Standardised Approach
- Implementation in Hong Kong
- Summary and Conclusion

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Historical Overview

BCBS (1997) set 11 principles:

- **qualitative** principles focused on management oversight, measuring, monitoring and internal controls;
- **No quantitative** standards and no capital consequences.

BCBS (2004) set 15 principles:

- Focus only on **banking book**;
- **Capital requirements** (based on Pillar 2 outlier approach);
- **Quantitative approach** (shocks to yield curve);
- **Outlier**: if in any shock scenario the bank's loss in economic value is more than 20% of its Tier 1 and 2 capital, it is an outlier.

Historical Overview

Changes in **market and supervisory practices** and persistently **low interest rate environment** after global financial crisis led BCBS to update IRRBB principles.

Keypoints of 12 BCBS (2016) principles:

- Detailed guidance on **standardised approach** provided;
- Six standardised **shock scenarios** to assess IRRBB;
- Focus on **economic value of equity** (EVE);
- Still **Pillar 2 outlier approach**;
- **Outlier**: if in any shock scenario the bank's loss in economic value is more than 15% of its Tier 1 capital, it is an outlier.

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IRRBB: BCBS Quantitative Approach

- Assess IRRBB by investigating effect of **changes in interest rates** on banks' **net interest income** (ΔNII) and **economic value of equity** (ΔEVE);

- ΔNII:
  - measures impact of **changes in interest rates** (two shock scenarios) on future profitability;
  - earnings based measure **complements ΔEVE metric** on which outlier methodology is based.

- ΔEVE:
  - measures impact of **changes in interest rates** on banking book's net present value (NPV);
  - intuitively, concept related to market value of a bank's equity, which is the residual when subtracting liabilities from assets;

$\rightarrow$In BCBS' **standardised approach**, ΔEVE is calculated in several steps...

IRRBB: Steps to Calculate Economic Value of Equity

1. For **given yield curve** and **currency**, slot cash flows of **interest rate-sensitive banking book positions** into 19 time bands according to **repricing maturities**;
   →Slotting example

2. Subtract liability cash flows from asset cash flows to get **net cash flow** for **each time band**, respectively;

3. Use yield curve to calculate **present value** of all 19 net cash flows. The sum of these discounted cash flows is the **economic value of equity** under yield curve scenario i and currency c: $EVE_{i,c}$.

→ Note: Changes in yield curve affect EVE...

IRRBB: Impact of Changing Interest Rates on EVE

Intuitively EVE is impacted by **changing interest rates** because

- changes in yield curve affect **discount factors** used as weights in summing up net cash flows in the 19 maturity bands;
- **cash-flows** of some positions depend on interest rates, for example **behavioural options** (fixed rate loans subject to prepayment risk and term deposits subject to early redemption risk);
- pricing of **automatic interest rate options** depends on interest rates.

$\rightarrow$BCBS **standardised interest rate shocks** cover a wide range of possible yield curves to assess conceivable EVE developments...

IRRBB: Interest Rate Scenarios

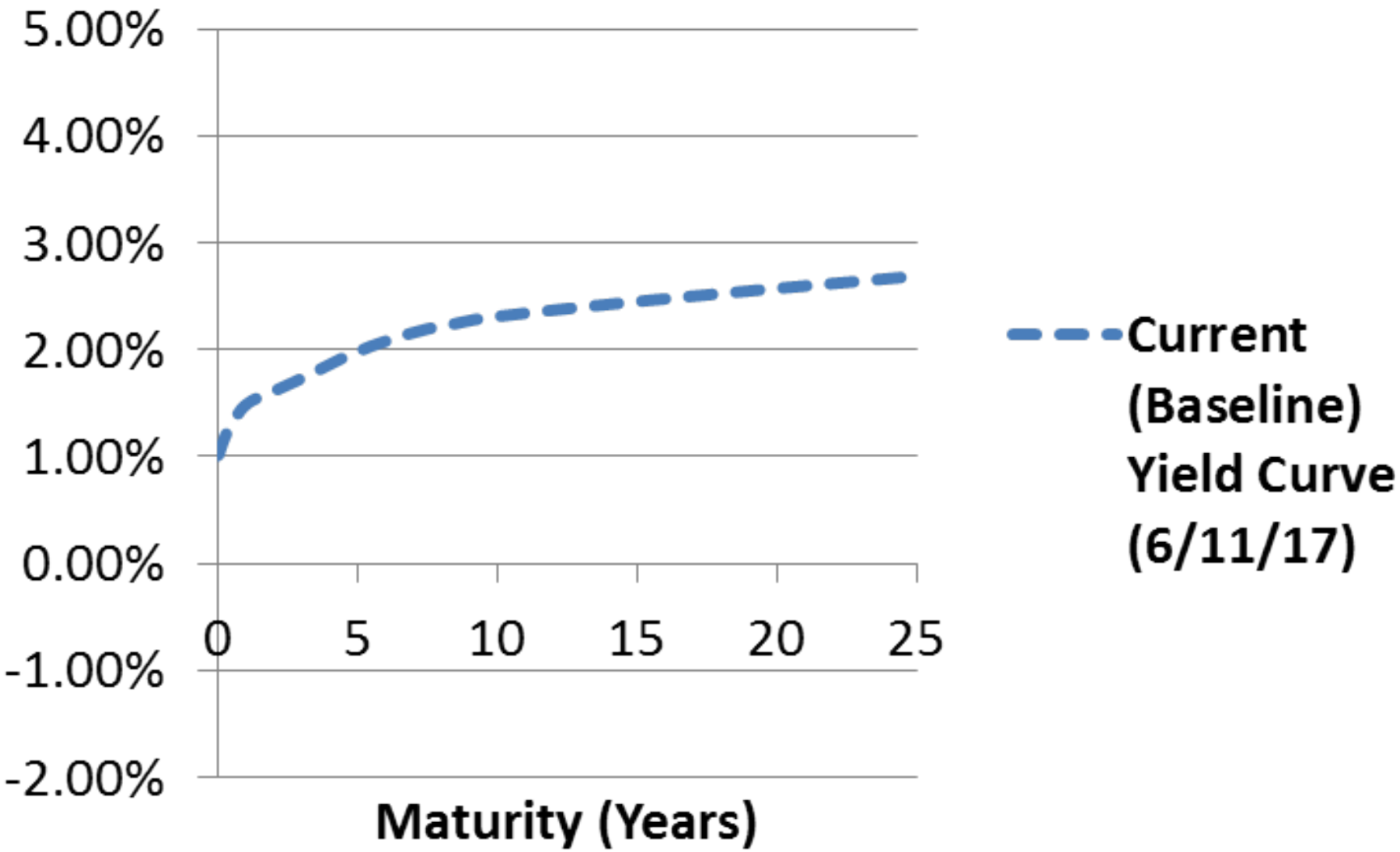
- Basel provides three interest rate **shock parameters** for each of 21 currencies: parallel, short and long shocks;

- Standardised shock scenarios provide **diverse range** of conceivable shifts to **current (baseline) yield curve**:
  - Scenario 1: parallel shift up;
  - Scenario 2: parallel shift down;
  - Scenario 3: steepening;
  - Scenario 4: flattening;
  - Scenario 5: short end moves up;
  - Scenario 6: short end moves down.

- Note: Each interest rate scenario features a distinct formula.

$\rightarrow$In the following consider a baseline and 6 standard interest rate scenarios for the **USD**...

IRRBB: Baseline Scenario (USD)



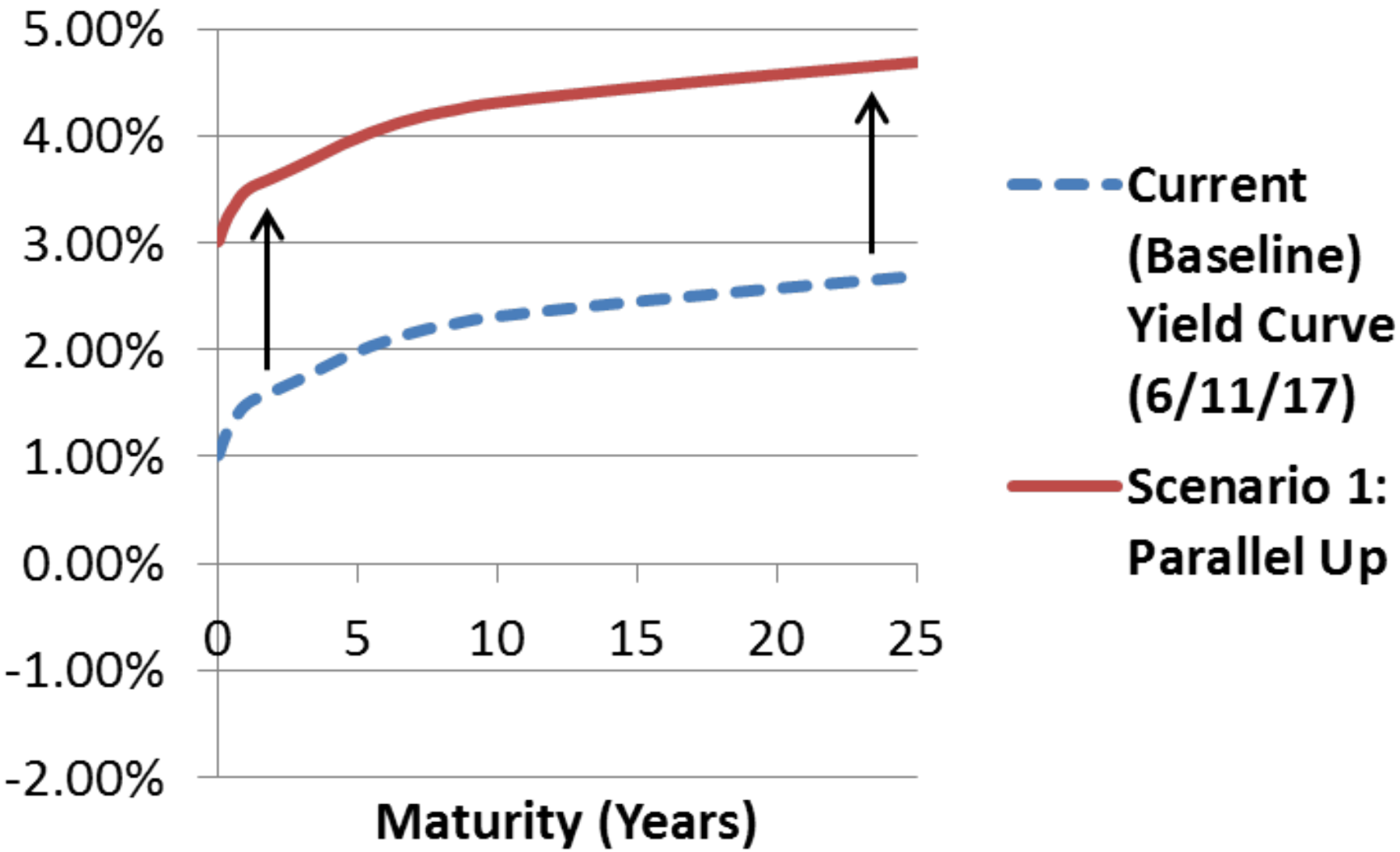
→Shock Scenario 1 implies **parallel upward shift** of baseline yield curve...

IRRBB: Parallel-Up Scenario (USD)

- New yield curve in scenario 1 obtained by: $R^1_{t,c} = R^0_{t,c} + \bar{R}_{parallel,c}$ with indices t and c indicating time band and currency, respectively, and index 0 indicating the baseline yield curve;

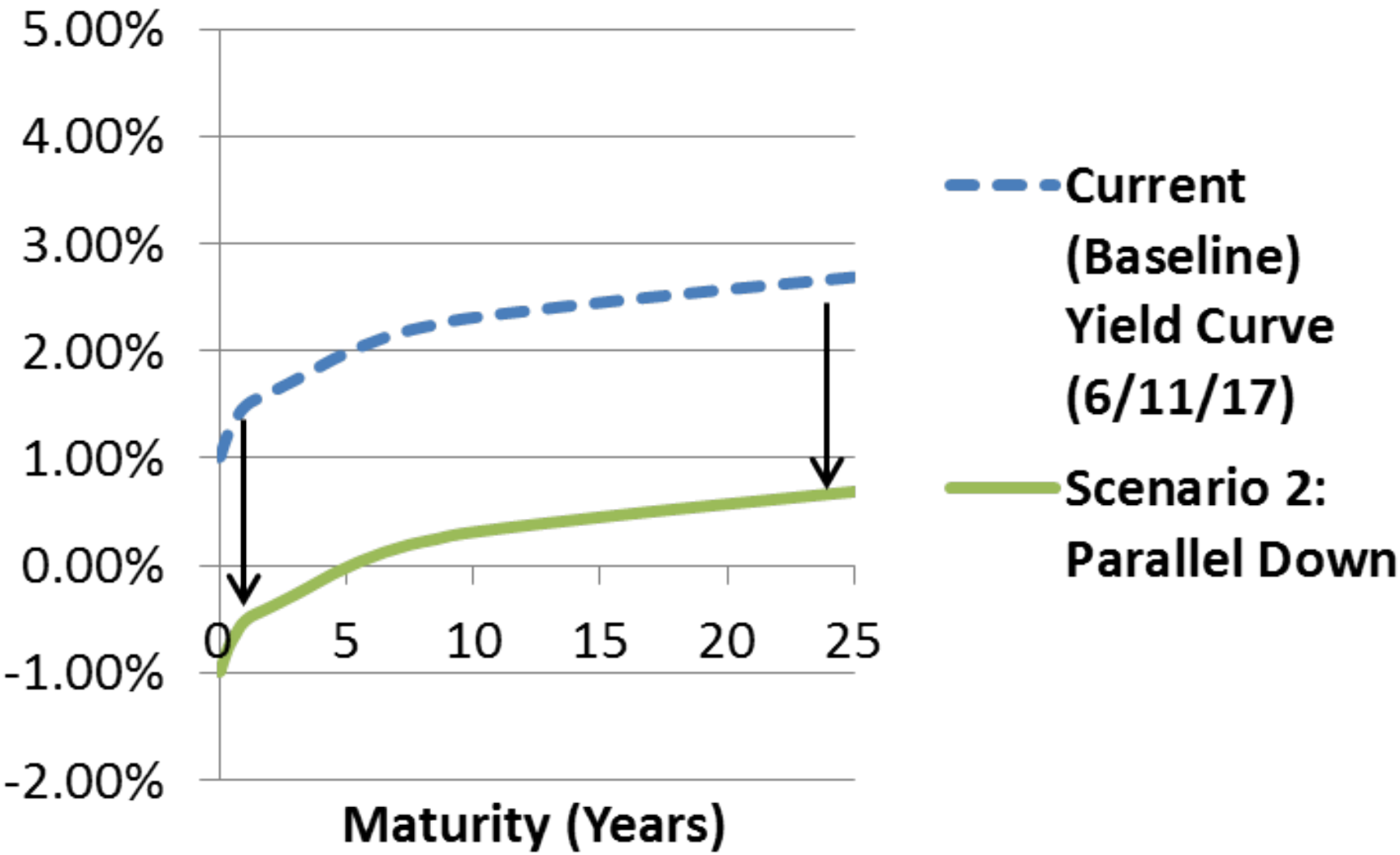
- Based on historical observations, different currencies feature different shock parameters:
  - $\bar{R}_{parallel,USD} = 200$
  - $\bar{R}_{parallel,EUR} = 200$
  - $\bar{R}_{parallel,JPY} = 100$
  - $\bar{R}_{parallel,CNY} = 250$
  - $\vdots$

IRRBB: Parallel-Up Scenario (USD)



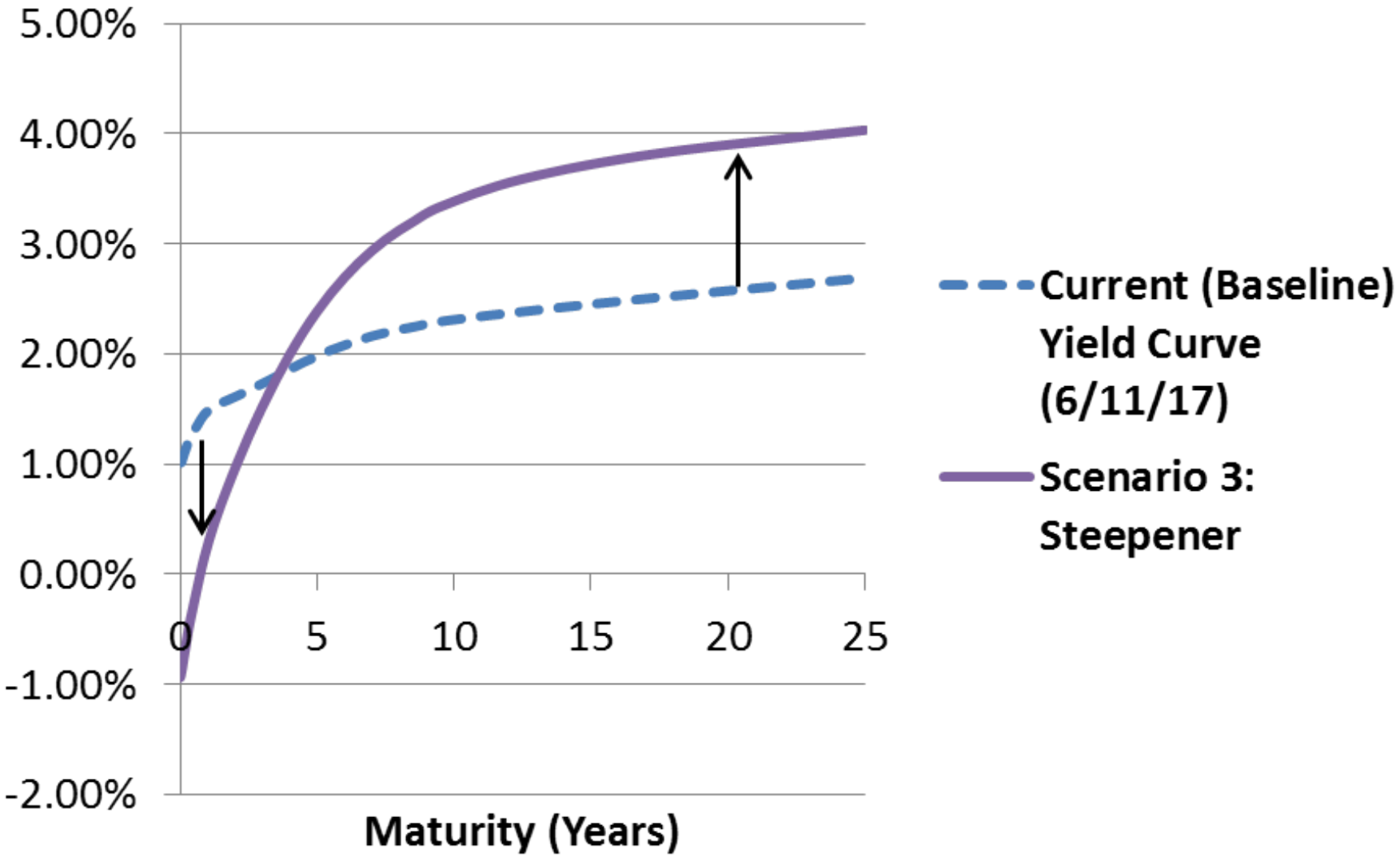
→Similar approach taken for **Scenario 2**, which implies **downward-shift**...

IRRBB: Parallel-Down Scenario (USD)



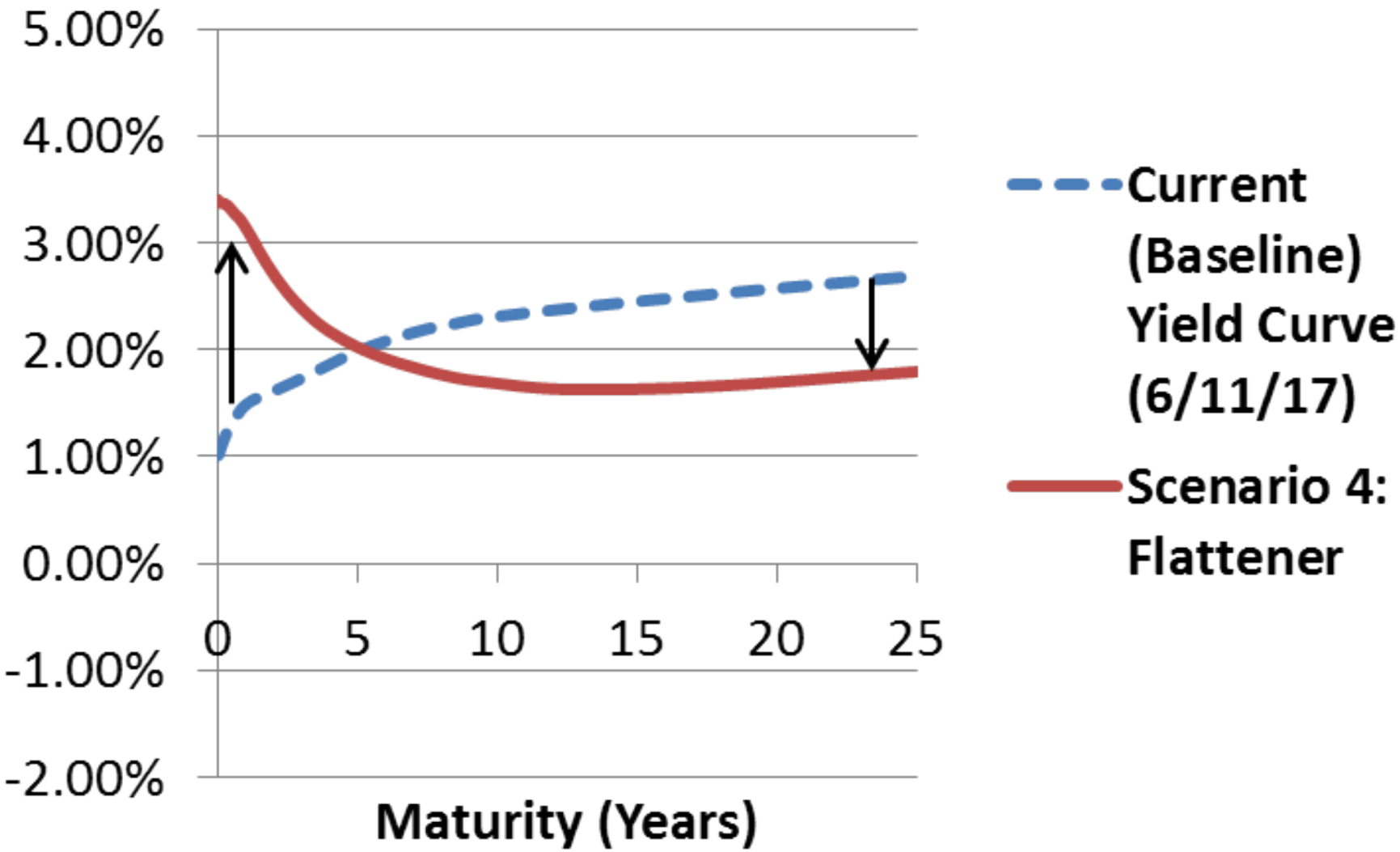
→**Scenario 3** involves **steepening** yield curve...

IRRBB: Steepener Scenario (USD)



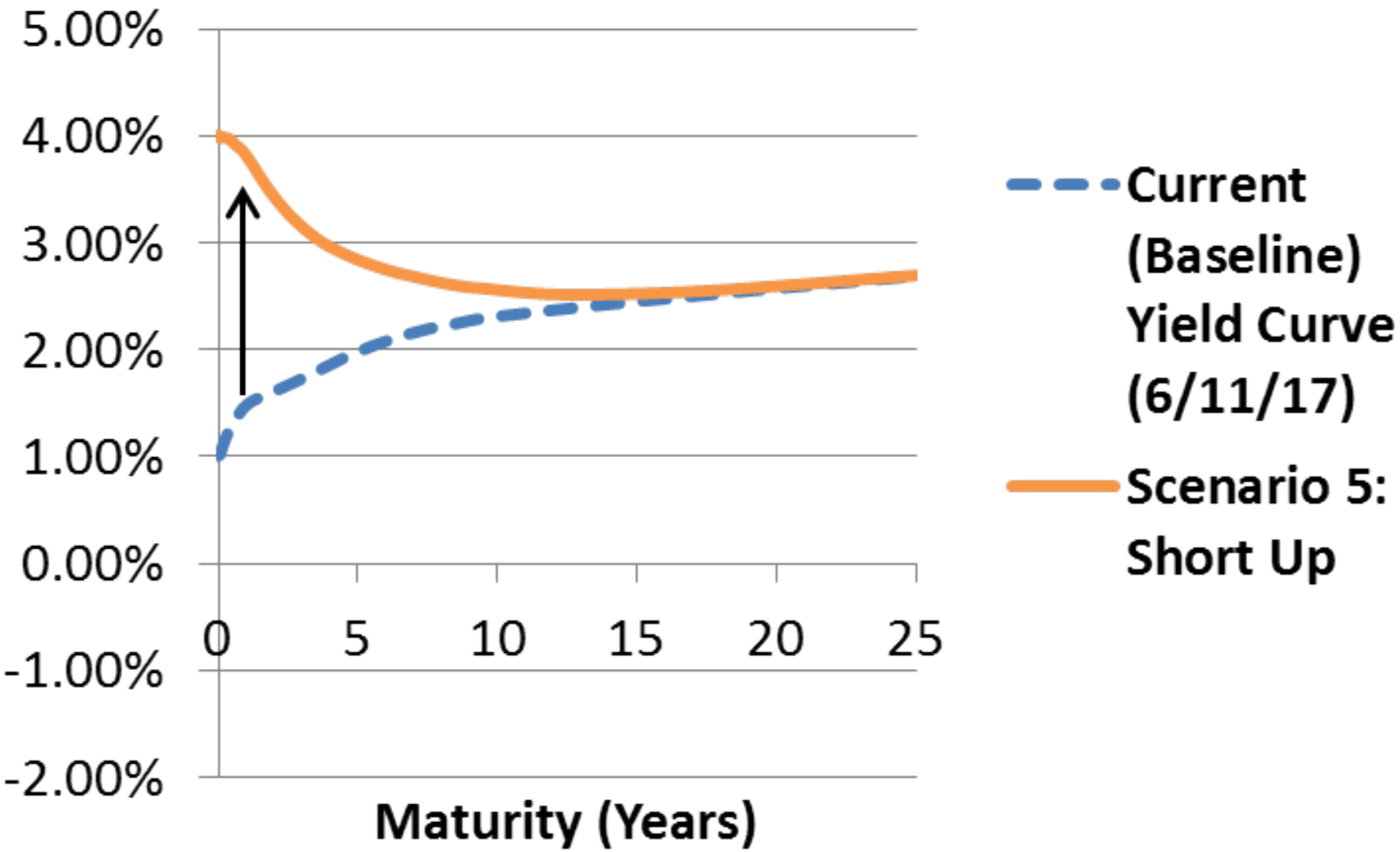
→**Scenario 4** implies yield curve **flattening**...

IRRBB: Flattener Scenario (USD)



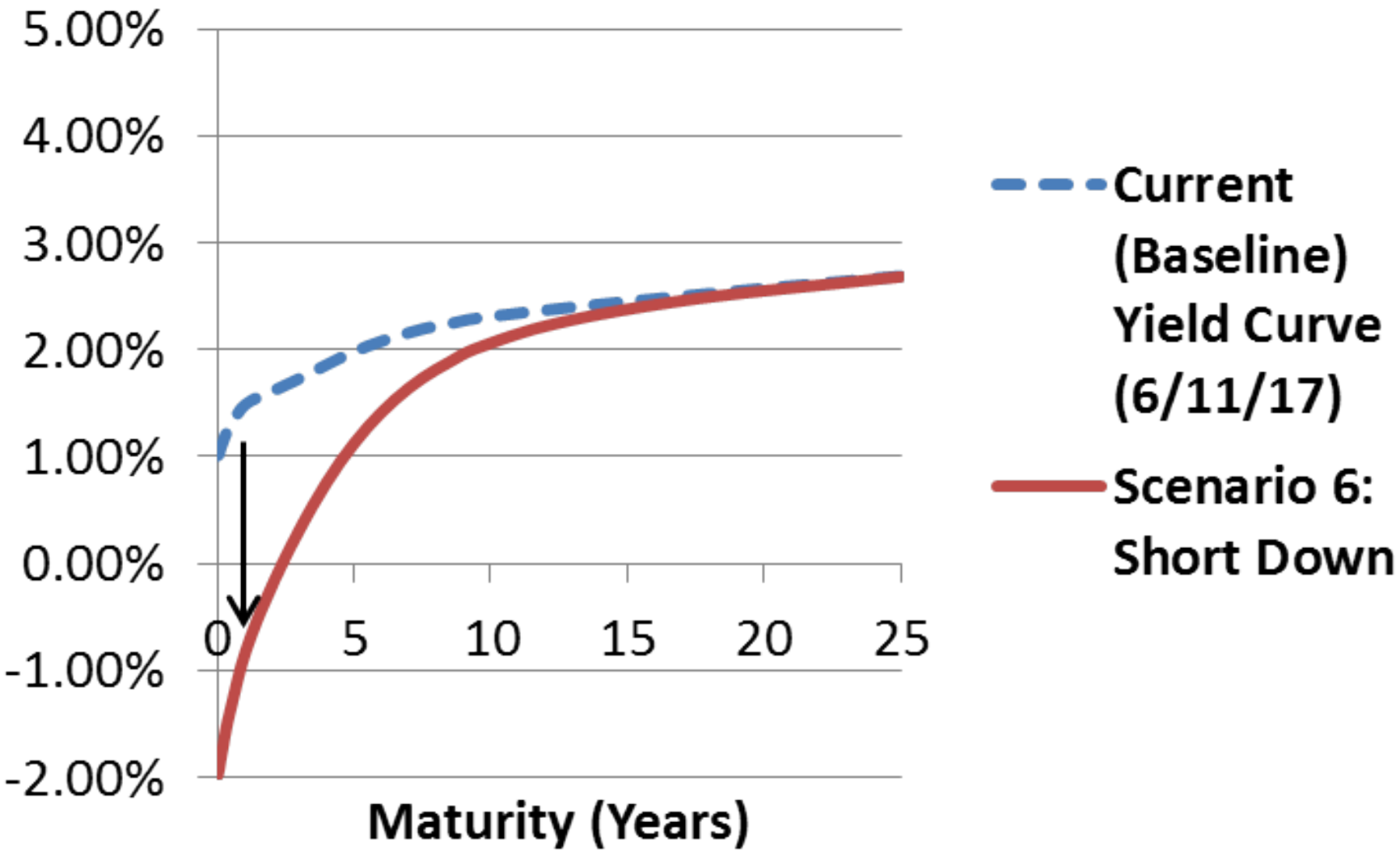
→**Scenario 5** implies an upward shock to **short end** of yield curve...

IRRBB: Short-Up Scenario (USD)



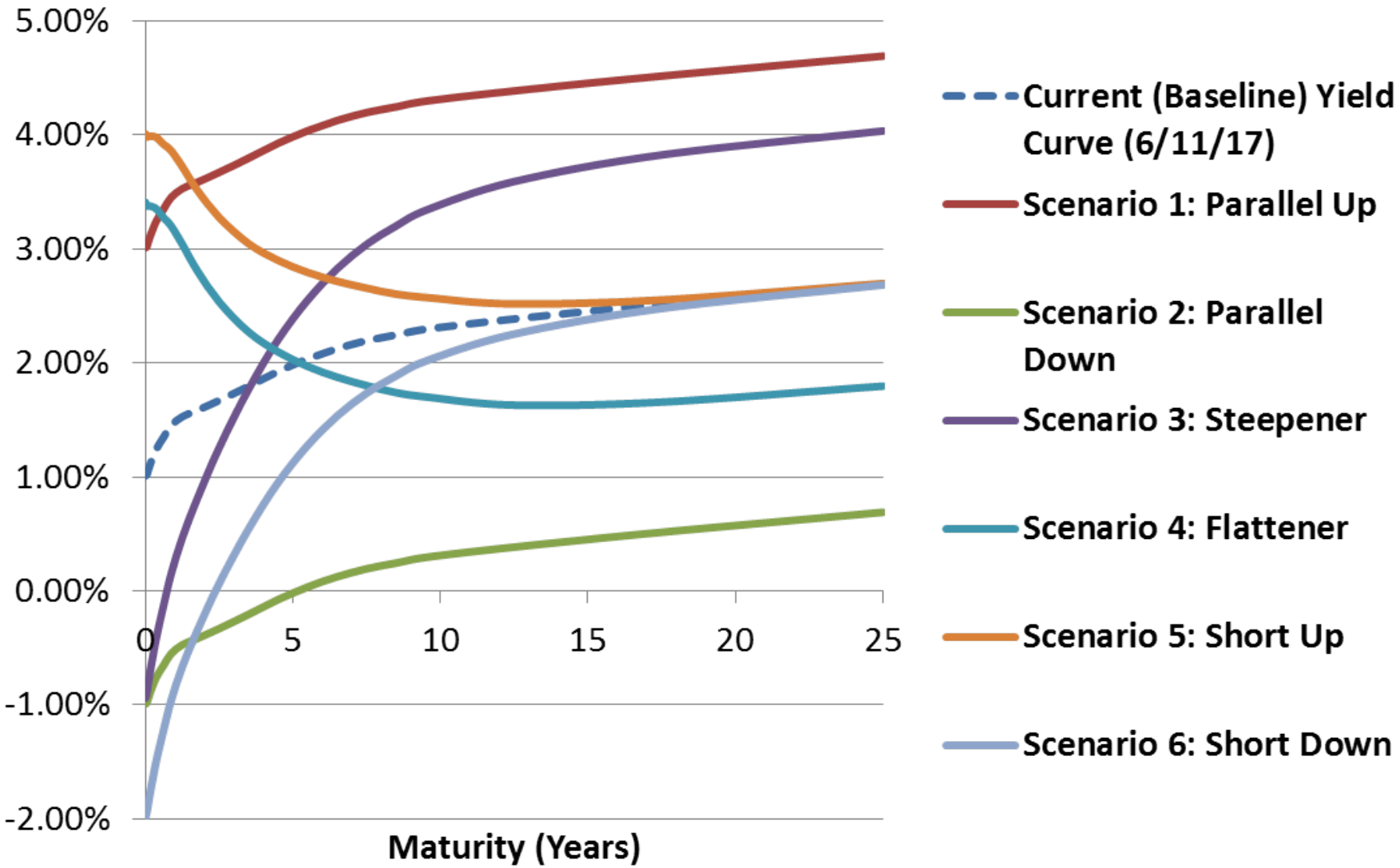
→**Scenario 6** implies a **downward shock** to **short end** of yield curve...

IRRBB: Short-Down Scenario (USD)



→Interest rate scenarios cover diverse possible yield curve developments...

IRRBB: All Scenarios (USD)



$\rightarrow$Diverse scenarios for interest rates key driver underlying ΔEVE calculation...

IRRBB: Summing Up Key Points of $EVE_{i,c}$

- $EVE_{i,c}$ is the net present value of interest sensitive banking book positions in currency c under interest rate scenario i;
- $EVE_{i,c}$ depends on the yield curve.

$\rightarrow$ $EVE_{i,c}$ is used to compute **standardised** ΔEVE which is the BCBS' primary metric to assess IRRBB...

IRRBB: ΔEVE Under the Standardised Approach

1. Calculate $\Delta EVE_{i,c} = EVE_{0,c} - EVE_{i,c}$
   Interpretation: $\Delta EVE_{i,c}$ is the loss in economic value of the banking book in currency c and scenario i;

2. Add changes in value of **automatic interest rate options** to $\Delta EVE_{i,c}$;

3. **Standardised** ΔEVE is the **maximum** of the worst aggregated reductions to EVE, across the six standardised interest rate shocks:

   $$\text{Standardised EVE measure} = \max_{i \in \{1,2,\ldots 6\}} \left(\sum_{c:\Delta EVE_{i,c}>0} \Delta EVE_{i,c} \right)$$

4. Banks whose standardised ΔEVE is in excess of 15% of their Tier 1 equity capital are **outliers**.

→ Standardised approach offers multiple advantages...

IRRBB: ΔEVE Under the Standardised Approach

- **Advantages** of standardised approach:
  - Comparability between institutions;
  - Prudent;
  - Less room for 'gaming the system';
  - Less resource intensive for industry.

- Problem of **internal modeling**, for example, of interest rate shocks based on **historical observations**: recent history does not feature much variation in underlying data (persistent low interest rate environment), impacting in turn behavioural modeling parameters;

- Note: Standardised approach reflected in **12 BCBS (2016) IRRBB principles**.

→ Local implementation requires AIs to follow **standardised ΔEVE approach** to assess IRRBB...

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Implementation in Hong Kong

- All **AIs required** to follow standardised ΔEVE approach (outlier test not applicable to overseas incorporated AIs);
- If AIs become outlier banks, **HKMA may review** whether AIs firm specific **internal model** better reflects IRRBB exposure;
- Interest rate scenarios can be **floored** at -2%;
- AIs must report all currencies until **90%** of banking book **covered**;
- Banks required to distinguish between **CNY** and **CNH** in IRRBB framework;
- **Implementation** in January 2019.

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Summary and Conclusion

- IRRBB is an **important risk** which requires supervision;
- Updated BCBS standards well suited to prepare banks for future **interest rate changes**;
- Standardised approach chosen by the HKMA is **prudent** and **robust**.

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Sources

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BCBS (2004): Principles for the Management and Supervision of Interest Rate Risk, Bank for International Settlements.

BCBS (2016): Interest rate risk in the banking book, Bank for International Settlements.

FDIC (1997): History of the Eighties, Volume I: An Examination of the Banking Crises of the 1980s and Early 1990s, Federal Deposit Insurance Corporation.

Example for Cash Flow Slotting

HKD 100m **fixed rate** loan; **maturity** 4 years, **interest rate** 4%, payable annually.

	Asset Cash flows
Next day or less:	
2 days to 1 month:	
1 to 3 months:	
3 to 6 months:	
6 to 9 months:	
9 to 12 months	4
1 to 1.5 years	
1.5 to 2 years	4
2 to 3 years	4
3 to 4 years	104
4 to 5 years	
5 to 6 years	
6 to 7 years	
7 to 8 years	
8 to 9 years	
9 to 10 years	
10 to 15 years	
15 to 20 years	
More than 20 years	

→back to EVE calculation